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ABSTRACT

An investigation was conducted to determine the effects of a modularized version of the Miltz (1971) "How to Explain Program" upon preservice elementary teachers enrolled in an educational foundations course, utilizing pupil performance as an indicator of explaining effectiveness. Specific objectives were to determine if: (1) use of the "How to Explain Program" results in higher teacher scores on a measure of explaining knowledge than no instruction in explaining; (2) elementary pupil concept attainment scores are affected by whether or not preservice teachers received the "How to Explain Program"; (3) a relationship exists between preservice teacher scores on a test of explaining knowledge and pupil mean scores on a concept attainment measure. Thirty-five preservice teachers were randomly assigned to a treatment and control group and require to teach a hypothetical geometric concept lesson to randomly selected groups of elementary pupils. Preservice teachers were tested for knowledge of explaining, and elementary pupils were tested for concept attainment. Pupils taught by the treatment group exhibited higher concept attainment scores than those taught by the control group. Treatment group preservice teachers also performed better on a test of explaining knowledge. No significant relationship was obtained between explaining and concept attainment scores. (Author)

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THE MILTZ (1971) HOW TO EXPLAIN PROGRAM AND ITS EFFECTS UPON PRESERVICE ELEMENTARY TEACHER EXPLAINING ABILITY (12.02)

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THE MILTZ (1971) HOW TO EXPLAIN PROGRAM AND ITS EFFECTS UPON PRESERVICE ELEMENTARY TEACHER EXPLAINING ABILITY

Introduction

Two kinds of evaluation research in teacher education are desirable and necessary, validating teaching skills and assessing training programs designed to develop specified skills. Explaining has been viewed as an essential part of the teaching-learning process, yet it is difficult to locate empirical research in which preservice teachers have been systematically trained to explain.

Evidence documenting the role explaining plays in everyday classroom processes is abundant and diverse. Researchers and observers in classrooms conclude that a large portion of instructional activity focuses upon teachers providing learners with information. Lecturing has been the traditional mode for transmitting information from teacher to learner, but today, even in non-traditional elementary classrooms, teachers also rely heavily upon asking questions and furnishing students with explanations (Carroll, 1968). Bellack (1966) identified categories of teacher talk and found that explaining and fact stating comprise 50 to 60 percent of teacher verbal behavior. A similar study investigating fifth grade teachers instead of secondary level teachers reported findings virtually identical to Bellack's (Stockton, 1969).

Inservice teachers have indicated they perceive explaining to be the most essential facet of classroom processes. A survey of 4,287 teachers in Georgia during the 1975-76 school years revealed explaining to be the competency listed as most essential to success in teaching (Johnson, et. al., 1976).

Studying the effectiveness of specified instructional material upon the explaining behavior of preservice teachers is important in providing teacher educators with information regarding the explaining process and its subsequent effects upon pupil progress and achievement. Further investigation is required to determine whether explaining is a teaching skill which may be specified and developed within teacher education programs.

Miltz (1971) used the results of several Stanford Studies coupled with readability research and Far West Laboratory materials to develop a "How to Explain Program" for prospective teachers. The program was designed to provide a model for explaining and furnish practice activities allowing students to utilize skills developed in sequential learning sessions. Validation of the program was conducted with 60 secondary education majors. Explanations of general science concepts were rated by seventh and eighth grade raters and transcriptions were coded by graduate students. Analysis of the data led Miltz to the conclusion "that the manual and the accompanying practice sessions probably had an effect in improving experimental group explanations."

Purpose or Problem

The purpose of this investigation was to determine the effects of a modularized version of the Miltz (1971) "How to Explain Program" upon preservice elementary teachers in an educational foundations course, and to utilize pupil performance data as an indicator of explaining effectiveness. Specific objectives of the study were to determine if: (1) use of the "How to Explain Program" results in higher scores on a measure of explaining knowledge than no instruction in explaining; (2) elementary pupil concept attainment scores would be affected by whether or not a preservice teacher received the "How to Explain Program";

(3) a relationship exists between preservice teacher scores on a test of explaining knowledge and pupil mean scores on a concept attainment measure?

Methods

Subjects. The thirty-five preservice elementary teachers who participated in this study were junior-year students enrolled in an educational foundations course and its accompanying field experience in a competency based teacher education program at the University of Georgia. The participants were randomly assigned to either a treatment or control group at the start of Fall Quarter, 1975. Students in the treatment group experienced the Miltz (1971) "How to Explain Program", a test of explaining knowledge and an orientation to a hypothetical geometric concept (IRT) prior to teaching the concept to small groups of elementary pupils and testing for concept attainment.

Instruction in explaining was provided by 5 self-instructional units of a "How to Explain Program" developed by Miltz (1971) and modified by the authors. Each of the five units required 90 minutes of instructional time for a total of seven and one-half hours. The program was designed to provide a model for explaining and to furnish practice activities allowing students to practice skills developed in each of the five modules of the program. The five modules were titled (1) Listening, (2) Structuring, (3) Application/Validity/Simplicity/Clarity, (4) Focus/Rule-Example-Rule/Vagueness/Summarizing, and (5) Check on Yourself. The activities were sequential so that skills developed in one module were necessary for completion of succeeding modules. The first two modules focus upon the logical order of explanations and selection

of content relating to basic structures of explanations. The remaining three modules focus upon the application of material contained in the previous modules and the actual giving of explanations.

Included in the content of each module are practice exercises to provide the learner with written and oral explaining experiences. Post-assessment or critique exercises culminate each module providing learners with the opportunity to work with a peer in practicing explaining developed in a particular module.

A second type of sample was also required to complete the study. Preservice teachers were randomly assigned to two elementary schools in the southeastern community in which the University is located. Elementary pupils were randomly assigned to mini-lesson groups of from six to nine pupils to be taught by the randomly chosen preservice teachers. Preservice teachers were required to teach a fifteen to twenty minute concept lesson to small groups of elementary pupils. Subject matter for the lessons was invented by the investigators. Findings of Williams (Note 2) and of past psychological research (Deese and Hulse, 1967); (Hull, 1921); (Bourne, 1966); (Gagne', 1970) were employed to provide background information concerning concept learning and the use of hypothetical geometric concepts as teaching and learning tasks.

The concept utilized was given the nonsense name IRT. The concept IRT was given a set of attributes to distinguish IRTs from non-IRTs. The following combination of attributes distinguished IRTs from non-IRTs: (1) three interconnected triangles, (2) the two intersections of the triangle are shaded, (3) a circle is located in the figure, (4) the circle is divided into equal top and bottom portions with a diagonal line parallel to the bottom

of the figure, (5) one of the two equal portions of the circle must be shaded, and (6) a rectangular shape--shaded or unshaded--must be located in the figure.

The use of geometric concepts has been established as a valuable research tool for a variety of reasons including: the novelty of concepts for both teacher and student; the independence of concepts from pupil reading ability; and the simplicity, familiarity and highly dimensionalized nature of geometric concepts. (Bourne, 1966)

A concept learning paradigm (Hull, 1921) frequently used today establishes a learning task involving stimuli, response, and a form of feedback to provide the learner with cues regarding task performance. Stimuli consisting of both examples and non-examples are presented to subjects with the stimuli varying along several dimensions. Four demonstration examples and non-examples were designed for the use of preservice teachers. The demonstration figures varied along the irrelevant dimensions of size of attributes, placement of shapes within the figure and shading of the circle. The non-examples, in addition to varying along these dimensions, also had one relevant attribute missing or displayed incorrectly. Only one relevant dimension was allowed to vary on each non-example.

Measuring Instruments

Module Test. Baseline information regarding control group knowledge of explaining was required to help determine effectiveness of the "How to Explain Program." An instrument was constructed to measure the content areas of the entire "How to Explain Program." Test questions were derived from major areas of the individual modules with two or three questions examining a particular

area. Test items were developed to accommodate a wide range of categories, insuring that a wide range of mental processes were required to answer test items. Recall and recognition of specific content, terminology, specification of facts; application of knowledge to new situations; and use of written skills developed in the modules were areas covered in the test.

The 36-item test utilized questions of both multiple choice and short answer variety. Eighteen test items required short answers or actual written explanations or parts of explanations. Grading was facilitated by the use of a code established to standardize the scoring of short answer responses.

Concept Comprehension Test. A twenty item concept comprehension test was developed in conjunction with the demonstration examples and non-examples. The test utilized was a "yes"/"no" instrument requiring elementary age pupils to circle "yes" if a test figure represented an IRT and circle "no" if they believed a test figure did not represent an IRT. Initially a ten item test had been selected, but the test was expanded to twenty items to insure greater reliability and variance.

Analysis

To determine if differences existed between the concept attainment scores of elementary pupils taught by treatment or control group teachers, a randomized one-way analysis of variance design was utilized.

A t-test was conducted on the explaining test scores to determine if differences existed between treatment and control group preservice teachers.

Pearson product moment correlations were calculated to determine what relationship existed between preservice teacher scores on a test of explaining knowledge and elementary pupil scores on a test of concept attainment.

Results

All randomly selected elementary pupils were administered a twenty item IRT concept attainment test following instruction by either a treatment or control group preservice teacher. The total mean score for the combined groups was 17.10 with a treatment group mean of 17.42 and a control group mean of 16.81. Standard deviation for pupils was 3.094. The twenty item concept attainment instrument utilized for the study was found to have a Chronbach Alpha reliability of .78. One-way analysis of variance (ANOVA) yielded an F ratio of 3.346, with a probability of .065. Table I shows mean scores for pupils taught by treatment and control group teachers and the overall means. Table II summarizes ANOVA.

TABLE I

Comparison of Concept Attainment Means

Treatment Group	Control Group	Total
$\bar{X}$ = 17.418 n = 126 N = 17	$\bar{X}$ = 16.81 n = 136 N = 18	$\bar{X}$ = 17.104 n = 262 N = 35

n = pupils
N = preservice teachers

TABLE II

Analysis of Variance on the Student Concept Attainment Measure

Source	Degrees of Freedom	Sum of Squares	Mean Square	F. Ratio
Between Groups	1	31.88	31.88	3.347*
Within Groups	260	2475.81	9.52	
Total	261	2507.69		

* probability (≤ .065)

All preservice teachers were administered a thirty-six item test of "How to Explain Program" content. Treatment group preservice teachers were administered the test following instruction in the "How to Explain Program" while control group teachers had not received instruction prior to test administration. The observed group mean for the treatment group was 29.52 while the control group mean was 18.33. A significant difference was obtained between treatment and control group scores on the test of program content. The t-value of 6.56 was significant at the .001 level. The test's Chronbach Alpha reliability was computed to be .8283.

TABLE III

t-Test Between Treatment and Control Group Module Content Test Scores

Number of Cases		Mean	St. Dev	t value	df
Control Group	18	18.77	4.41	*-6.56	33
Experimental Group	17	29.47	3.98		

probability < .001

The Pearson product-moment correlation of r = .104 between pupil concept attainment scores and preservice teacher "How to Explain Program" knowledge scores was not significant.

Discussion

Elementary pupils taught by preservice teachers receiving instruction in the "How to Explain Program" performed better ($p < .065$) than pupils taught by teachers not receiving instruction. Differences obtained in the present investigation might be viewed with caution for a variety of reasons however. Both treatment and control mean scores were above the 75 percent mastery level. These skewed test scores were disappointing because the investigators had anticipated larger differences between treatment and control groups. Obtaining significant differences, despite the overall high level of pupil performance, may be viewed as indicative of the merits of the "How to Explain Program" and explaining as a skill that may be developed in teacher education programs. The concept attainment test utilized for pupils in grades one through five may not have been able to effectively discriminate between control and experimental group differences at the fourth and fifth grade levels. Analysis of intermediate and primary level concept attainment responses indicated older pupils recording significantly higher test means than primary pupils. This particular finding contradicts results reported by Williams (Note 2) in a study investigating inductive versus deductive methods of concept teaching. Another confounding variable may have been the schedules established for treatment and control groups. Control group participants were assigned to elementary classrooms for an extra week prior to teaching the hypothetical concept lesson to pupils. An extra week of experience during the first quarter in a teacher education program may have significantly inflated the pupil performance data.

Nevertheless, preservice elementary teachers can improve their knowledge of explaining by completing self-instructional materials that provide instruction

in explaining skills. This finding supports the results of the initial validation study conducted by Miltz (1971). The findings also imply that preservice teachers have poorly developed explaining skills without instruction in explaining. For example, only one control group participant achieved the mastery level on a measure of explaining knowledge prior to participating in the five "How to Explain" sessions.

Use of a novel teaching task may have systematically eliminated the factor of familiarity with teaching material. Glass (1973) contends familiarity with material may be a variable which separates successful from unsuccessful teachers. Use of a structured lesson plan in addition to a novel teaching task may have further decreased differences between group variability in response to IRT concept lessons. By supplying both a novel teaching task and an accompanying lesson plan to participants, the investigation hoped to account for teacher inexperience and the wide variety of academic backgrounds included in the large portion of transfer students in the preservice teacher sample.

Attempts at utilizing module content scores as predictors of pupil performance were not successful. An overall correlation between pupil concept scores and the accompanying teacher knowledge of explaining scores did not approach significance. Individual correlations did not approach significance and no significant differences were found between correlation coefficients.

While the present study does not attempt to conclusively answer many questions concerning teacher explaining behavior, it does provide more information regarding the use of the Miltz (1971) "How to Explain Program," use of pupil performance data as a method of evaluating preservice teacher effectiveness, and the use of hypothetical concepts as a teaching task.

Inclusion of some method of observation to supplement pupil performance data and teacher scores on a measure of "How to Explain Program" content may yield information presenting more definitive differences between a control and experimental group than those reported in the present study. Observation techniques may furnish data indicating the extent to which desirable explaining techniques are employed and which of the factors outlined in the "How to Explain Program" contribute most heavily to a successful explanation. A study encompassing pupil performance data, measures of explaining knowledge and observation data may be better able to answer the three-fold question of whether teachers attain content which learning materials attempt to teach, whether teachers put skills obtained from training materials into use, and whether the use of skills obtained from learning materials affects pupil performance.

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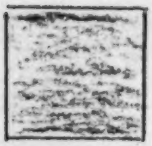
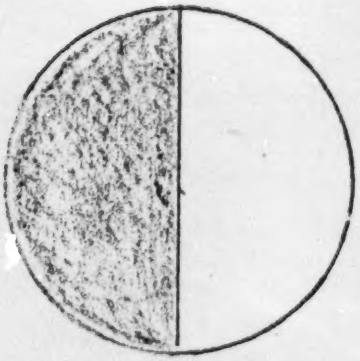
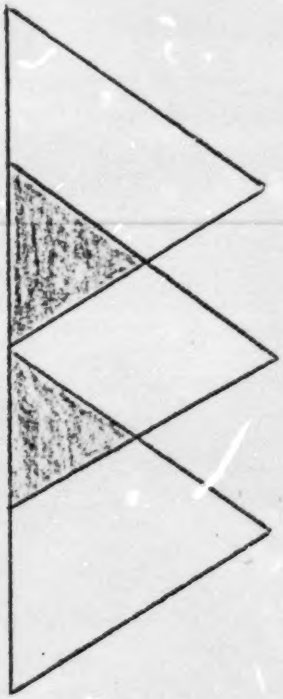
APPENDIX I

Teaching Example 1







APPENDIX II

IRT Concept Comprehension Test